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<sup>12</sup>C<sup>16</sup>O laser frequency tables for the  
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$^{12}\text{C}^{16}\text{O}$  Laser Frequency Tables for the  
34.2 to 62.3 THz (1139 to 2079  $\text{cm}^{-1}$ ) Region

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Frequencies for  $^{12}\text{C}^{16}\text{O}$  laser transitions are tabulated for the spectral range from 34.2 to 62.3 THz (1139 to 2079  $\text{cm}^{-1}$ ). The transition frequencies were calculated using molecular constants which were derived from heterodyne frequency measurements on the  $^{12}\text{C}^{16}\text{O}$  laser.

Key words: carbon monoxide laser;  $^{12}\text{C}^{16}\text{O}$  laser spectra; frequency tables; infrared; IR calibration frequencies.

Calculated CO laser frequencies are tabulated for transitions over a spectral range from 34.2 to 62.3 THz (1139 to 2079  $\text{cm}^{-1}$ ). They correspond to transitions with lower vibrational quantum numbers ranging from  $v'' = 2$  to  $v'' = 37$  and with lower rotational quantum numbers between  $J''=3$  and  $J''=26$ . The calculations are based on heterodyne frequency measurements of CO laser transitions [1]. A pair of  $\text{CO}_2$  lasers was used as references for these measurements. Altogether 140 CO laser frequencies were measured, 48 of them were Doppler-free. The transition frequencies were fitted to the Dunham expression in which the energy of any vibrational-rotational level is given by the expansion:

$$E(v,J) = \sum_{k,l} Y_{k,l} (v+1/2)^k (J(J+1))^l . \quad (1)$$

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In order to improve the fit, we also used a number of CO transition frequencies from previous works [2,3,4]. For further details about the heterodyne measurements of the CO laser frequencies and the data handling, refer to ref. [1].

The CO frequencies tabulated in this work are calculated using eq (1); they are based on the set of Dunham coefficients given in ref. [1] and reproduced in table 1.

The CO laser transition frequencies tabulated in table 2 are ordered with respect to the different vibrational bands. The assignment of a transition,  $P(J'')_{v''}$ , follows the convention where  $v''$  and  $J''$  are the vibrational and rotational quantum numbers of the lower state of the lasing transition.

The accuracy of the listed CO transitions varies according to the uncertainty and spectral distribution of the measurements which determine the constants of table 1. We estimate an absolute uncertainty in the frequencies of  $\pm 200$  kHz in the frequency region between 50.6 THz and 57.5 THz ( $1688\text{ cm}^{-1}$  and  $1918\text{ cm}^{-1}$ ).

The uncertainty in the rest of the tabulation is best described by breaking it into two parts. For the CO transitions which normally lase, we estimate an uncertainty of  $\pm 2$  MHz. (For example, this might include the  $7 \leq J'' \leq 16$  region for liquid-nitrogen-cooled operation and  $10 \leq J'' \leq 20$  for sealed-off operation with dry-ice and alcohol cooling.) However, for those transitions with rotational and vibrational quantum numbers outside the region covered by the fit in ref. [1], the corresponding accuracy becomes worse. For more detailed information, see ref. [1], especially figure 2.

Table 1. Dunham coefficients for  $^{12}\text{C}^{16}\text{O}$  laser lines

Coef.:	Value [MHz]	Uncertainty [MHz]
$Y_{01}$	0.5789834412D+05	(0.784D-02)
$Y_{02}$	-0.1835195249D+00	(0.216D-04)
$Y_{03}$	0.1730174733D-06	(0.228D-07)
$Y_{10}$	0.6504933627D+08	(0.116D+01)
$Y_{11}$	-0.5247559337D+03	(0.928D-03)
$Y_{12}$	0.2718413289D-04	(0.192D-05)
$Y_{13}$	-0.4534252199D-08 <sup>a</sup>	
$Y_{20}$	-0.3983542578D+06	(0.658D+00)
$Y_{21}$	0.1507565858D-01	(0.190D-03)
$Y_{22}$	-0.3793618583D-05	(0.214D-06)
$Y_{23}$	-0.4410831745D-10 <sup>a</sup>	
$Y_{30}$	0.3108285993D+03	(0.139D+00)
$Y_{31}$	0.4646472836D-03	(0.911D-05)
$Y_{32}$	-0.1076462931D-06	(0.577D-08)
$Y_{40}$	0.2217510379D+01	(0.154D-01)
$Y_{41}$	0.4092398185D-04	(0.123D-06)
$Y_{42}$	0.4978153305D-08 <sup>a</sup>	
$Y_{50}$	-0.3556930730D-02	(0.102D-02)
$Y_{51}$	-0.1747762292D-06 <sup>a</sup>	
$Y_{52}$	-0.1413396166D-09 <sup>a</sup>	
$Y_{60}$	0.3837288335D-03	(0.404D-04)
$Y_{61}$	-0.4299405019D-07 <sup>a</sup>	
$Y_{70}$	-0.3260895808D-04	(0.954D-06)
$Y_{80}$	0.4589172485D-06	(0.123D-07)
$Y_{90}$	-0.2917514858D-08	(0.668D-10)

<sup>a</sup>Fixed at the value indicated.



Table 2. Tables of  $^{12}\text{C}^{16}\text{O}$  laser transitions

Vibrational band: $v = 3 \rightarrow 2$			Vibrational band: $v = 4 \rightarrow 3$		
Transition $P(J'')_{v''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]	Transition $P(J'')_{v''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_2$	62325278.44	2078.94751	$P(3)_3$	61538573.83	2052.70587
$P(4)_2$	62208984.59	2075.06837	$P(4)_3$	61423329.54	2048.86173
$P(5)_2$	62091659.05	2071.15481	$P(5)_3$	61307053.67	2044.98319
$P(6)_2$	61973306.23	2067.20698	$P(6)_3$	61189750.60	2041.07038
$P(7)_2$	61853930.54	2063.22504	$P(7)_3$	61071424.74	2037.12345
$P(8)_2$	61733536.36	2059.20912	$P(8)_3$	60952080.49	2033.14256
$P(9)_2$	61612128.11	2055.15938	$P(9)_3$	60831722.24	2029.12784
$P(10)_2$	61489710.17	2051.07595	$P(10)_3$	60710354.40	2025.07944
$P(11)_2$	61366286.96	2046.95900	$P(11)_3$	60587981.35	2020.99752
$P(12)_2$	61241862.86	2042.80866	$P(12)_3$	60464607.51	2016.88221
$P(13)_2$	61116442.28	2038.62508	$P(13)_3$	60340237.25	2012.73366
$P(14)_2$	60990029.59	2034.40840	$P(14)_3$	60214874.97	2008.55203
$P(15)_2$	60862629.21	2030.15878	$P(15)_3$	60088525.06	2004.33745
$P(16)_2$	60734245.52	2025.87637	$P(16)_3$	59961191.91	2000.09007
$P(17)_2$	60604882.90	2021.56129	$P(17)_3$	59832879.90	1995.81004
$P(18)_2$	60474545.74	2017.21371	$P(18)_3$	59703593.41	1991.49751
$P(19)_2$	60343238.43	2012.83377	$P(19)_3$	59573336.84	1987.15262
$P(20)_2$	60210965.34	2008.42162	$P(20)_3$	59442114.54	1982.77552
$P(21)_2$	60077730.86	2003.97739	$P(21)_3$	59309930.90	1978.36634
$P(22)_2$	59943539.36	1999.50125	$P(22)_3$	59176790.29	1973.92525
$P(23)_2$	59808395.22	1994.99332	$P(23)_3$	59042697.08	1969.45238
$P(24)_2$	59672302.79	1990.45377	$P(24)_3$	58907655.63	1964.94788
$P(25)_2$	59535266.45	1985.88273	$P(25)_3$	58771670.30	1960.41190



Table 2. (cont.)

Vibrational band:  $\nu = 5 \rightarrow 4$ 

Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_4$	60753944.71	2026.53346
$P(4)_4$	60639749.94	2022.72433
$P(5)_4$	60524523.69	2018.88080
$P(6)_4$	60408270.34	2015.00300
$P(7)_4$	60290994.30	2011.09110
$P(8)_4$	60172699.97	2007.14522
$P(9)_4$	60053391.75	2003.16553
$P(10)_4$	59933074.02	1999.15216
$P(11)_4$	59811751.20	1995.10527
$P(12)_4$	59689427.66	1991.02499
$P(13)_4$	59566107.80	1986.91149
$P(14)_4$	59441796.01	1982.76489
$P(15)_4$	59316496.68	1978.58535
$P(16)_4$	59190214.19	1974.37302
$P(17)_4$	59062952.92	1970.12805
$P(18)_4$	58934717.26	1965.85056
$P(19)_4$	58805511.58	1961.54073
$P(20)_4$	58675340.25	1957.19868
$P(21)_4$	58544207.64	1952.82457
$P(22)_4$	58412118.13	1948.41853
$P(23)_4$	58279076.08	1943.98073
$P(24)_4$	58145085.84	1939.51129
$P(25)_4$	58010151.78	1935.01038

Vibrational band:  $\nu = 6 \rightarrow 5$ 

Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_5$	59971442.90	2000.43201
$P(4)_5$	59858297.59	1996.65789
$P(5)_5$	59744120.90	1992.84936
$P(6)_5$	59628917.25	1989.00658
$P(7)_5$	59512691.01	1985.12969
$P(8)_5$	59395446.60	1981.21884
$P(9)_5$	59277188.42	1977.27417
$P(10)_5$	59157920.84	1973.29583
$P(11)_5$	59037648.27	1969.28397
$P(12)_5$	58916375.10	1965.23874
$P(13)_5$	58794105.72	1961.16027
$P(14)_5$	58670844.51	1957.04872
$P(15)_5$	58546595.87	1952.90423
$P(16)_5$	58421364.16	1948.72695
$P(17)_5$	58295153.77	1944.51702
$P(18)_5$	58167969.09	1940.27460
$P(19)_5$	58039814.47	1935.99982
$P(20)_5$	57910694.30	1931.69283
$P(21)_5$	57780612.94	1927.35379
$P(22)_5$	57649574.75	1922.98282
$P(23)_5$	57517584.10	1918.58009
$P(24)_5$	57384645.34	1914.14573
$P(25)_5$	57250762.82	1909.67989

Table 2. (cont.)

Vibrational band: $\nu = 7 \rightarrow 6$			Vibrational band: $\nu = 8 \rightarrow 7$		
Transition $P(J'')_{\nu''}$	frequency [MHz]	[ $\text{cm}^{-1}$ ]	Transition $P(J'')_{\nu''}$	frequency [MHz]	[ $\text{cm}^{-1}$ ]
$P(3)_6$	59191119.45	1974.40322	$P(3)_7$	58413024.29	1948.44876
$P(4)_6$	59079023.52	1970.66410	$P(4)_7$	58301977.65	1944.74464
$P(5)_6$	58965896.35	1966.89059	$P(5)_7$	58189899.93	1941.00613
$P(6)_6$	58851742.34	1963.08282	$P(6)_7$	58076795.51	1937.23337
$P(7)_6$	58736565.89	1959.24095	$P(7)_7$	57962668.80	1933.42652
$P(8)_6$	58620371.39	1955.36511	$P(8)_7$	57847524.19	1929.58571
$P(9)_6$	58503163.24	1951.45547	$P(9)_7$	57731366.07	1925.71109
$P(10)_6$	58384945.84	1947.51216	$P(10)_7$	57614198.85	1921.80281
$P(11)_6$	58265723.57	1943.53534	$P(11)_7$	57496026.90	1917.86102
$P(12)_6$	58145500.82	1939.52514	$P(12)_7$	57376854.63	1913.88586
$P(13)_6$	58024281.99	1935.48171	$P(13)_7$	57256686.40	1909.87748
$P(14)_6$	57902071.45	1931.40521	$P(14)_7$	57135526.61	1905.83602
$P(15)_6$	57778873.59	1927.29577	$P(15)_7$	57013379.64	1901.76164
$P(16)_6$	57654692.79	1923.15354	$P(16)_7$	56890249.86	1897.65447
$P(17)_6$	57529533.43	1918.97868	$P(17)_7$	56766141.66	1893.51467
$P(18)_6$	57403399.88	1914.77131	$P(18)_7$	56641059.39	1889.34237
$P(19)_6$	57276296.51	1910.53160	$P(19)_7$	56515007.43	1885.13773
$P(20)_6$	57148227.68	1906.25969	$P(20)_7$	56387990.15	1880.90089
$P(21)_6$	57019197.78	1901.95571	$P(21)_7$	56260011.90	1876.63200
$P(22)_6$	56889211.14	1897.61982	$P(22)_7$	56131077.05	1872.33119
$P(23)_6$	56758272.14	1893.25217	$P(23)_7$	56001189.93	1867.99863
$P(24)_6$	56626385.12	1888.85289	$P(24)_7$	55870354.92	1863.63444
$P(25)_6$	56493554.43	1884.42214	$P(25)_7$	55738576.34	1859.23878

Table 2. (cont.)

Vibrational band:  $\nu = 9 \rightarrow 8$ 

Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_8$	57637205.74	1922.57024
$P(4)_8$	57527208.30	1918.90112
$P(5)_8$	57416179.94	1915.19761
$P(6)_8$	57304125.04	1911.45986
$P(7)_8$	57191048.01	1907.68802
$P(8)_8$	57076953.25	1903.88223
$P(9)_8$	56961845.15	1900.04263
$P(10)_8$	56845728.10	1896.16939
$P(11)_8$	56728606.50	1892.26263
$P(12)_8$	56610484.72	1888.32251
$P(13)_8$	56491367.15	1884.34918
$P(14)_8$	56371258.17	1880.34277
$P(15)_8$	56250162.17	1876.30344
$P(16)_8$	56128083.51	1872.23134
$P(17)_8$	56005026.58	1868.12660
$P(18)_8$	55880995.73	1863.98938
$P(19)_8$	55755995.34	1859.81981
$P(20)_8$	55630029.77	1855.61805
$P(21)_8$	55503103.37	1851.38425
$P(22)_8$	55375220.50	1847.11853
$P(23)_8$	55246385.51	1842.82106
$P(24)_8$	55116602.75	1838.49197
$P(25)_8$	54985876.55	1834.13142

Vibrational band:  $\nu = 10 \rightarrow 9$ 

Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_9$	56863710.05	1896.76920
$P(4)_9$	56754761.69	1893.13507
$P(5)_9$	56644782.58	1889.46656
$P(6)_9$	56533777.12	1885.76382
$P(7)_9$	56421749.71	1882.02699
$P(8)_9$	56308704.75	1878.25622
$P(9)_9$	56194646.62	1874.45165
$P(10)_9$	56079579.72	1870.61343
$P(11)_9$	55963508.44	1866.74171
$P(12)_9$	55846437.17	1862.83663
$P(13)_9$	55728370.28	1858.89834
$P(14)_9$	55609312.16	1854.92699
$P(15)_9$	55489267.18	1850.92272
$P(16)_9$	55368239.72	1846.88568
$P(17)_9$	55246234.15	1842.81601
$P(18)_9$	55123254.84	1838.71386
$P(19)_9$	54999306.15	1834.57938
$P(20)_9$	54874392.43	1830.41271
$P(21)_9$	54748518.05	1826.21399
$P(22)_9$	54621687.34	1821.98337
$P(23)_9$	54493904.68	1817.72100
$P(24)_9$	54365174.38	1813.42702
$P(25)_9$	54235500.79	1809.10157

Table 2. (cont.)

Vibrational band: $\nu = 11 \rightarrow 10$			Vibrational band: $\nu = 12 \rightarrow 11$		
Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]	Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{10}$	56092580.82	1871.04710	$P(3)_{11}$	55323858.41	1845.40528
$P(4)_{10}$	55984681.41	1867.44796	$P(4)_{11}$	55217007.78	1841.84112
$P(5)_{10}$	55875751.43	1863.81445	$P(5)_{11}$	55109126.80	1838.24260
$P(6)_{10}$	55765795.30	1860.14671	$P(6)_{11}$	55000219.87	1834.60986
$P(7)_{10}$	55654817.41	1856.44488	$P(7)_{11}$	54890291.39	1830.94304
$P(8)_{10}$	55542822.16	1852.70912	$P(8)_{11}$	54779345.75	1827.24229
$P(9)_{10}$	55429813.94	1848.93957	$P(9)_{11}$	54667387.34	1823.50776
$P(10)_{10}$	55315797.15	1845.13638	$P(10)_{11}$	54554420.57	1819.73959
$P(11)_{10}$	55200776.16	1841.29970	$P(11)_{11}$	54440449.81	1815.93794
$P(12)_{10}$	55084755.37	1837.42966	$P(12)_{11}$	54325479.46	1812.10294
$P(13)_{10}$	54967739.16	1833.52642	$P(13)_{11}$	54209513.88	1808.23474
$P(14)_{10}$	54849731.91	1829.59012	$P(14)_{11}$	54092557.47	1804.33350
$P(15)_{10}$	54730737.98	1825.62091	$P(15)_{11}$	53974614.59	1800.39935
$P(16)_{10}$	54610761.77	1821.61893	$P(16)_{11}$	53855689.61	1796.43244
$P(17)_{10}$	54489807.62	1817.58434	$P(17)_{11}$	53735786.91	1792.43291
$P(18)_{10}$	54367879.92	1813.51727	$P(18)_{11}$	53614910.84	1788.40092
$P(19)_{10}$	54244983.01	1809.41787	$P(19)_{11}$	53493065.77	1784.33661
$P(20)_{10}$	54121121.26	1805.28628	$P(20)_{11}$	53370256.04	1780.24012
$P(21)_{10}$	53996299.01	1801.12266	$P(21)_{11}$	53246486.00	1776.11159
$P(22)_{10}$	53870520.62	1796.92715	$P(22)_{11}$	53121760.01	1771.95118
$P(23)_{10}$	53743790.43	1792.69988	$P(23)_{11}$	52996082.40	1767.75903
$P(24)_{10}$	53616112.78	1788.44101	$P(24)_{11}$	52869457.51	1763.53528
$P(25)_{10}$	53487492.00	1784.15069	$P(25)_{11}$	52741889.67	1759.28007

Table 2. (cont.)

Vibrational band:  $\nu = 13 \rightarrow 12$ 

Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{12}$	54557579.29	1819.84496
$P(4)_{12}$	54451777.29	1816.31578
$P(5)_{12}$	54344945.14	1812.75225
$P(6)_{12}$	54237087.25	1809.15449
$P(7)_{12}$	54128208.02	1805.52267
$P(8)_{12}$	54018311.86	1801.85693
$P(9)_{12}$	53907403.15	1798.15742
$P(10)_{12}$	53795486.29	1794.42427
$P(11)_{12}$	53682565.66	1790.65764
$P(12)_{12}$	53568645.64	1786.85768
$P(13)_{12}$	53453730.62	1783.02453
$P(14)_{12}$	53337824.98	1779.15833
$P(15)_{12}$	53220933.08	1775.25924
$P(16)_{12}$	53103059.30	1771.32739
$P(17)_{12}$	52984208.00	1767.36294
$P(18)_{12}$	52864383.55	1763.36603
$P(19)_{12}$	52743590.29	1759.33680
$P(20)_{12}$	52621832.58	1755.27540
$P(21)_{12}$	52499114.77	1751.18197
$P(22)_{12}$	52375441.19	1747.05667
$P(23)_{12}$	52250816.20	1742.89962
$P(24)_{12}$	52125244.12	1738.71099
$P(25)_{12}$	51998729.27	1734.49091

Vibrational band:  $\nu = 14 \rightarrow 13$ 

Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{13}$	53793775.43	1794.36720
$P(4)_{13}$	53689021.85	1790.87300
$P(5)_{13}$	53583238.34	1787.34444
$P(6)_{13}$	53476429.32	1783.78168
$P(7)_{13}$	53368599.19	1780.18485
$P(8)_{13}$	53259752.34	1776.55411
$P(9)_{13}$	53149893.16	1772.88960
$P(10)_{13}$	53039026.05	1769.19147
$P(11)_{13}$	52927155.40	1765.45987
$P(12)_{13}$	52814285.59	1761.69494
$P(13)_{13}$	52700421.00	1757.89682
$P(14)_{13}$	52585566.00	1754.06567
$P(15)_{13}$	52469724.97	1750.20163
$P(16)_{13}$	52352902.28	1746.30485
$P(17)_{13}$	52235102.28	1742.37546
$P(18)_{13}$	52116329.35	1738.41362
$P(19)_{13}$	51996587.82	1734.41948
$P(20)_{13}$	51875882.06	1730.39317
$P(21)_{13}$	51754216.40	1726.33484
$P(22)_{13}$	51631595.19	1722.24463
$P(23)_{13}$	51508022.76	1718.12270
$P(24)_{13}$	51383503.44	1713.96918
$P(25)_{13}$	51258041.56	1709.78423



Table 2. (cont.)

Vibrational band: $v = 15 \rightarrow 14$			Vibrational band: $v = 16 \rightarrow 15$		
Transition $P(J'')_{v''}$	frequency [MHz]	[ $\text{cm}^{-1}$ ]	Transition $P(J'')_{v''}$	frequency [MHz]	[ $\text{cm}^{-1}$ ]
$P(3)_{14}$	53032473.57	1768.97291	$P(3)_{15}$	52273694.57	1743.66276
$P(4)_{14}$	52928768.21	1765.51367	$P(4)_{15}$	52171037.20	1740.23848
$P(5)_{14}$	52824033.14	1762.02008	$P(5)_{15}$	52067350.35	1736.77986
$P(6)_{14}$	52718272.78	1758.49230	$P(6)_{15}$	51962638.43	1733.28705
$P(7)_{14}$	52611491.53	1754.93046	$P(7)_{15}$	51856905.83	1729.76019
$P(8)_{14}$	52503693.79	1751.33471	$P(8)_{15}$	51750156.96	1726.19943
$P(9)_{14}$	52394883.95	1747.70521	$P(9)_{15}$	51642396.22	1722.60492
$P(10)_{14}$	52285066.41	1744.04209	$P(10)_{15}$	51533628.00	1718.97680
$P(11)_{14}$	52174245.55	1740.34550	$P(11)_{15}$	51423856.68	1715.31522
$P(12)_{14}$	52062425.75	1736.61559	$P(12)_{15}$	51313086.65	1711.62033
$P(13)_{14}$	51949611.40	1732.85251	$P(13)_{15}$	51201322.29	1707.89227
$P(14)_{14}$	51835806.86	1729.05640	$P(14)_{15}$	51088567.97	1704.13119
$P(15)_{14}$	51721016.52	1725.22741	$P(15)_{15}$	50974828.06	1700.33724
$P(16)_{14}$	51605244.74	1721.36568	$P(16)_{15}$	50860106.94	1696.51056
$P(17)_{14}$	51488495.88	1717.47135	$P(17)_{15}$	50744408.95	1692.65129
$P(18)_{14}$	51370774.29	1713.54458	$P(18)_{15}$	50627738.46	1688.75958
$P(19)_{14}$	51252084.33	1709.58551	$P(19)_{15}$	50510099.81	1684.83557
$P(20)_{14}$	51132430.35	1705.59429	$P(20)_{15}$	50391497.35	1680.87942
$P(21)_{14}$	51011816.69	1701.57105	$P(21)_{15}$	50271935.43	1676.89127
$P(22)_{14}$	50890247.69	1697.51594	$P(22)_{15}$	50151418.37	1672.87125
$P(23)_{14}$	50767727.68	1693.42911	$P(23)_{15}$	50029950.50	1668.81952
$P(24)_{14}$	50644260.97	1689.31071	$P(24)_{15}$	49907536.15	1664.73621
$P(25)_{14}$	50519851.91	1685.16087	$P(25)_{15}$	49784179.63	1660.62148



Table 2. (cont.)

Vibrational band: $\nu = 17 \rightarrow 16$			Vibrational band: $\nu = 18 \rightarrow 17$		
Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]	Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{16}$	51517452.72	1718.43725	$P(3)_{17}$	50763754.99	1693.29660
$P(4)_{16}$	51415843.10	1715.04792	$P(4)_{17}$	50663192.88	1689.94221
$P(5)_{16}$	51313204.22	1711.62425	$P(5)_{17}$	50561601.70	1686.55349
$P(6)_{16}$	51209540.47	1708.16640	$P(6)_{17}$	50458985.84	1683.13060
$P(7)_{16}$	51104856.26	1704.67451	$P(7)_{17}$	50355349.72	1679.67367
$P(8)_{16}$	50999155.99	1701.14873	$P(8)_{17}$	50250697.74	1676.18285
$P(9)_{16}$	50892444.06	1697.58921	$P(9)_{17}$	50145034.30	1672.65830
$P(10)_{16}$	50784724.87	1693.99608	$P(10)_{17}$	50038363.79	1669.10015
$P(11)_{16}$	50676002.79	1690.36950	$P(11)_{17}$	49930690.59	1665.50856
$P(12)_{16}$	50566282.22	1686.70962	$P(12)_{17}$	49822019.11	1661.88367
$P(13)_{16}$	50455567.53	1683.01657	$P(13)_{17}$	49712353.70	1658.22563
$P(14)_{16}$	50343863.11	1679.29051	$P(14)_{17}$	49601698.76	1654.53458
$P(15)_{16}$	50231173.30	1675.53159	$P(15)_{17}$	49490058.64	1650.81066
$P(16)_{16}$	50117502.49	1671.73994	$P(16)_{17}$	49377437.71	1647.05403
$P(17)_{16}$	50002855.03	1667.91571	$P(17)_{17}$	49263840.32	1643.26483
$P(18)_{16}$	49887235.28	1664.05905	$P(18)_{17}$	49149270.83	1639.44321
$P(19)_{16}$	49770647.58	1660.17010	$P(19)_{17}$	49033733.59	1635.58930
$P(20)_{16}$	49653096.27	1656.24901	$P(20)_{17}$	48917232.94	1631.70325
$P(21)_{16}$	49534585.70	1652.29593	$P(21)_{17}$	48799773.20	1627.78522
$P(22)_{16}$	49415120.19	1648.31099	$P(22)_{17}$	48681358.71	1623.83534
$P(23)_{16}$	49294704.07	1644.29434	$P(23)_{17}$	48561993.80	1619.85375
$P(24)_{16}$	49173341.66	1640.24612	$P(24)_{17}$	48441682.77	1615.84061
$P(25)_{16}$	49051037.27	1636.16649	$P(25)_{17}$	48320429.94	1611.79605

Table 2. (cont.)

Vibrational band: $\nu = 19 \rightarrow 18$			Vibrational band: $\nu = 20 \rightarrow 19$		
Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]	Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{18}$	50012600.38	1668.24078	$P(3)_{19}$	49263979.19	1643.26946
$P(4)_{18}$	49913085.53	1664.92132	$P(4)_{19}$	49165511.34	1639.98493
$P(5)_{18}$	49812541.77	1661.56754	$P(5)_{19}$	49066014.70	1636.66608
$P(6)_{18}$	49710973.50	1658.17959	$P(6)_{19}$	48965493.70	1633.31306
$P(7)_{18}$	49608385.14	1654.75761	$P(7)_{19}$	48863952.74	1629.92602
$P(8)_{18}$	49504781.09	1651.30175	$P(8)_{19}$	48761396.24	1626.50510
$P(9)_{18}$	49400165.76	1647.81216	$P(9)_{19}$	48657828.59	1623.05046
$P(10)_{18}$	49294543.53	1644.28898	$P(10)_{19}$	48553254.18	1619.56223
$P(11)_{18}$	49187918.80	1640.73236	$P(11)_{19}$	48447677.42	1616.04057
$P(12)_{18}$	49080295.95	1637.14245	$P(12)_{19}$	48341102.68	1612.48562
$P(13)_{18}$	48971679.36	1633.51939	$P(13)_{19}$	48233534.34	1608.89752
$P(14)_{18}$	48862073.40	1629.86333	$P(14)_{19}$	48124976.78	1605.27643
$P(15)_{18}$	48751482.44	1626.17441	$P(15)_{19}$	48015434.36	1601.62249
$P(16)_{18}$	48639910.84	1622.45279	$P(16)_{19}$	47904911.44	1597.93584
$P(17)_{18}$	48527362.97	1618.69859	$P(17)_{19}$	47793412.38	1594.21664
$P(18)_{18}$	48413843.16	1614.91198	$P(18)_{19}$	47680941.53	1590.46501
$P(19)_{18}$	48299355.76	1611.09309	$P(19)_{19}$	47567503.23	1586.68112
$P(20)_{18}$	48183905.12	1607.24207	$P(20)_{19}$	47453101.81	1582.86510
$P(21)_{18}$	48067495.56	1603.35907	$P(21)_{19}$	47337741.60	1579.01709
$P(22)_{18}$	47950131.41	1599.44422	$P(22)_{19}$	47221426.93	1575.13725
$P(23)_{18}$	47831816.99	1595.49768	$P(23)_{19}$	47104162.10	1571.22572
$P(24)_{18}$	47712556.60	1591.51958	$P(24)_{19}$	46985951.43	1567.28264
$P(25)_{18}$	47592354.56	1587.51007	$P(25)_{19}$	46866799.22	1563.30815

Table 2. (cont.)

Vibrational band: $\nu = 21 \rightarrow 20$			Vibrational band: $\nu = 22 \rightarrow 21$		
Transition $P(J'')_{\nu''}$	frequency [MHz]	[ $\text{cm}^{-1}$ ]	Transition $P(J'')_{\nu''}$	frequency [MHz]	[ $\text{cm}^{-1}$ ]
$P(3)_{20}$	48517872.29	1618.38202	$P(3)_{21}$	47774250.44	1593.57746
$P(4)_{20}$	48420451.19	1615.13240	$P(4)_{21}$	47677875.83	1590.36275
$P(5)_{20}$	48322001.38	1611.84847	$P(5)_{21}$	47580472.56	1587.11373
$P(6)_{20}$	48222527.30	1608.53037	$P(6)_{21}$	47482045.05	1583.83054
$P(7)_{20}$	48122033.36	1605.17825	$P(7)_{21}$	47382597.71	1580.51333
$P(8)_{20}$	48020523.97	1601.79226	$P(8)_{21}$	47282134.96	1577.16226
$P(9)_{20}$	47918003.52	1598.37255	$P(9)_{21}$	47180661.20	1573.77746
$P(10)_{20}$	47814476.43	1594.91926	$P(10)_{21}$	47078180.84	1570.35908
$P(11)_{20}$	47709947.07	1591.43253	$P(11)_{21}$	46974698.25	1566.90727
$P(12)_{20}$	47604419.83	1587.91252	$P(12)_{21}$	46870217.84	1563.42218
$P(13)_{20}$	47497899.10	1584.35937	$P(13)_{21}$	46764743.97	1559.90395
$P(14)_{20}$	47390389.25	1580.77323	$P(14)_{21}$	46658281.01	1556.35273
$P(15)_{20}$	47281894.63	1577.15424	$P(15)_{21}$	46550833.35	1552.76866
$P(16)_{20}$	47172419.61	1573.50255	$P(16)_{21}$	46442405.32	1549.15189
$P(17)_{20}$	47061968.55	1569.81830	$P(17)_{21}$	46333001.29	1545.50257
$P(18)_{20}$	46950545.79	1566.10163	$P(18)_{21}$	46222625.59	1541.82083
$P(19)_{20}$	46838155.66	1562.35270	$P(19)_{21}$	46111282.57	1538.10682
$P(20)_{20}$	46724802.51	1558.57165	$P(20)_{21}$	45998976.55	1534.36070
$P(21)_{20}$	46610490.65	1554.75861	$P(21)_{21}$	45885711.85	1530.58260
$P(22)_{20}$	46495224.41	1550.91375	$P(22)_{21}$	45771492.79	1526.77266
$P(23)_{20}$	46379008.09	1547.03719	$P(23)_{21}$	45656323.67	1522.93103
$P(24)_{20}$	46261846.00	1543.12908	$P(24)_{21}$	45540208.79	1519.05785
$P(25)_{20}$	46143742.44	1539.18957	$P(25)_{21}$	45423152.45	1515.15327

Table 2. (cont.)

Vibrational band: $\nu = 23 \rightarrow 22$			Vibrational band: $\nu = 24 \rightarrow 23$		
Transition $P(J'')_{\nu''}$	frequency [MHz]	[ $\text{cm}^{-1}$ ]	Transition $P(J'')_{\nu''}$	frequency [MHz]	[ $\text{cm}^{-1}$ ]
$P(3)_{22}$	47033073.51	1568.85446	$P(3)_{23}$	46294289.82	1544.21129
$P(4)_{22}$	46937745.18	1565.67465	$P(4)_{23}$	46200007.58	1541.06637
$P(5)_{22}$	46841388.15	1562.46053	$P(5)_{23}$	46104696.51	1537.88714
$P(6)_{22}$	46744006.84	1559.21223	$P(6)_{23}$	46008361.04	1534.67373
$P(7)_{22}$	46645605.68	1555.92993	$P(7)_{23}$	45911005.61	1531.42630
$P(8)_{22}$	46546189.08	1552.61374	$P(8)_{23}$	45812634.61	1528.14500
$P(9)_{22}$	46445761.44	1549.26384	$P(9)_{23}$	45713252.48	1524.82997
$P(10)_{22}$	46344327.16	1545.88036	$P(10)_{23}$	45612863.60	1521.48136
$P(11)_{22}$	46241890.64	1542.46344	$P(11)_{23}$	45511472.37	1518.09931
$P(12)_{22}$	46138456.27	1539.01324	$P(12)_{23}$	45409083.18	1514.68397
$P(13)_{22}$	46034028.42	1535.52990	$P(13)_{23}$	45305700.40	1511.23550
$P(14)_{22}$	45928611.46	1532.01357	$P(14)_{23}$	45201328.41	1507.75402
$P(15)_{22}$	45822209.77	1528.46439	$P(15)_{23}$	45095971.57	1504.23970
$P(16)_{22}$	45714827.68	1524.88251	$P(16)_{23}$	44989634.24	1500.69266
$P(17)_{22}$	45606469.56	1521.26808	$P(17)_{23}$	44882320.75	1497.11307
$P(18)_{22}$	45497139.74	1517.62123	$P(18)_{23}$	44774035.45	1493.50106
$P(19)_{22}$	45386842.56	1513.94211	$P(19)_{23}$	44664782.67	1489.85678
$P(20)_{22}$	45275582.35	1510.23087	$P(20)_{23}$	44554566.72	1486.18037
$P(21)_{22}$	45163363.41	1506.48765	$P(21)_{23}$	44443391.93	1482.47198
$P(22)_{22}$	45050190.06	1502.71259	$P(22)_{23}$	44331262.60	1478.73175
$P(23)_{22}$	44936066.61	1498.90584	$P(23)_{23}$	44218183.01	1474.95982
$P(24)_{22}$	44820997.33	1495.06754	$P(24)_{23}$	44104157.46	1471.15634
$P(25)_{22}$	44704986.53	1491.19784	$P(25)_{23}$	43989190.23	1467.32144

Table 2. (cont.)

Vibrational band: $\nu = 25 \rightarrow 24$			Vibrational band: $\nu = 26 \rightarrow 25$		
Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]	Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{24}$	45557835.36	1519.64581	$P(3)_{25}$	44823633.00	1495.15546
$P(4)_{24}$	45464599.04	1516.53578	$P(4)_{25}$	44731442.50	1492.08031
$P(5)_{24}$	45370333.67	1513.39143	$P(5)_{25}$	44638222.61	1488.97083
$P(6)_{24}$	45275043.69	1510.21290	$P(6)_{25}$	44543977.76	1485.82716
$P(7)_{24}$	45178733.52	1507.00034	$P(7)_{25}$	44448712.41	1482.64945
$P(8)_{24}$	45081407.59	1503.75389	$P(8)_{25}$	44352430.95	1479.43785
$P(9)_{24}$	44983070.30	1500.47371	$P(9)_{25}$	44255137.82	1476.19250
$P(10)_{24}$	44883726.06	1497.15995	$P(10)_{25}$	44156837.42	1472.91355
$P(11)_{24}$	44783379.27	1493.81274	$P(11)_{25}$	44057534.14	1469.60115
$P(12)_{24}$	44682034.31	1490.43223	$P(12)_{25}$	43957232.37	1466.25544
$P(13)_{24}$	44579695.56	1487.01858	$P(13)_{25}$	43855936.48	1462.87658
$P(14)_{24}$	44476367.39	1483.57192	$P(14)_{25}$	43753650.86	1459.46470
$P(15)_{24}$	44372054.15	1480.09241	$P(15)_{25}$	43650379.85	1456.01995
$P(16)_{24}$	44266760.22	1476.58018	$P(16)_{25}$	43546127.80	1452.54247
$P(17)_{24}$	44160489.92	1473.03539	$P(17)_{25}$	43440899.06	1449.03242
$P(18)_{24}$	44053247.59	1469.45817	$P(18)_{25}$	43334697.96	1445.48993
$P(19)_{24}$	43945037.56	1465.84867	$P(19)_{25}$	43227528.82	1441.91515
$P(20)_{24}$	43835864.14	1462.20704	$P(20)_{25}$	43119395.95	1438.30823
$P(21)_{24}$	43725731.64	1458.53341	$P(21)_{25}$	43010303.66	1434.66930
$P(22)_{24}$	43614644.36	1454.82794	$P(22)_{25}$	42900256.22	1430.99851
$P(23)_{24}$	43502606.60	1451.09076	$P(23)_{25}$	42789257.93	1427.29601
$P(24)_{24}$	43389622.61	1447.32202	$P(24)_{25}$	42677313.06	1423.56193
$P(25)_{24}$	43275696.69	1443.52186	$P(25)_{25}$	42564425.86	1419.79642



Table 2. (cont.)

Vibrational band: $\nu = 27 \rightarrow 26$			Vibrational band: $\nu = 28 \rightarrow 27$		
Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]	Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{26}$	44091591.75	1470.73719	$P(3)_{27}$	43361605.91	1446.38748
$P(4)_{26}$	44000447.02	1467.69693	$P(4)_{27}$	43271506.98	1443.38211
$P(5)_{26}$	43908272.42	1464.62232	$P(5)_{27}$	43180377.55	1440.34236
$P(6)_{26}$	43815072.40	1461.51350	$P(6)_{27}$	43088222.07	1437.26838
$P(7)_{26}$	43720851.40	1458.37062	$P(7)_{27}$	42995044.99	1434.16033
$P(8)_{26}$	43625613.84	1455.19384	$P(8)_{27}$	42900850.73	1431.01835
$P(9)_{26}$	43529364.14	1451.98330	$P(9)_{27}$	42805643.71	1427.84258
$P(10)_{26}$	43432106.71	1448.73914	$P(10)_{27}$	42709428.35	1424.63318
$P(11)_{26}$	43333845.95	1445.46151	$P(11)_{27}$	42612209.04	1421.39030
$P(12)_{26}$	43234586.24	1442.15056	$P(12)_{27}$	42513990.17	1418.11407
$P(13)_{26}$	43134331.96	1438.80644	$P(13)_{27}$	42414776.12	1414.80464
$P(14)_{26}$	43033087.48	1435.42929	$P(14)_{27}$	42314571.26	1411.46217
$P(15)_{26}$	42930857.15	1432.01925	$P(15)_{27}$	42213379.94	1408.08679
$P(16)_{26}$	42827645.33	1428.57648	$P(16)_{27}$	42111206.50	1404.67865
$P(17)_{26}$	42723456.35	1425.10111	$P(17)_{27}$	42008055.28	1401.23789
$P(18)_{26}$	42618294.53	1421.59329	$P(18)_{27}$	41903930.59	1397.76467
$P(19)_{26}$	42512164.20	1418.05316	$P(19)_{27}$	41798836.76	1394.25912
$P(20)_{26}$	42405069.66	1414.48087	$P(20)_{27}$	41692778.08	1390.72138
$P(21)_{26}$	42297015.21	1410.87656	$P(21)_{27}$	41585758.83	1387.15160
$P(22)_{26}$	42188005.12	1407.24038	$P(22)_{27}$	41477783.30	1383.54993
$P(23)_{26}$	42078043.67	1403.57246	$P(23)_{27}$	41368855.74	1379.91649
$P(24)_{26}$	41967135.12	1399.87295	$P(24)_{27}$	41258980.41	1376.25145
$P(25)_{26}$	41855283.73	1396.14198	$P(25)_{27}$	41148161.55	1372.55493



Table 2. (cont.)

Vibrational band:  $\nu = 29 \rightarrow 28$ 

Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{28}$	42633554.21	1422.10229
$P(4)_{28}$	42544501.21	1419.13181
$P(5)_{28}$	42454416.89	1416.12692
$P(6)_{28}$	42363305.72	1413.08777
$P(7)_{28}$	42271172.13	1410.01453
$P(8)_{28}$	42178020.58	1406.90733
$P(9)_{28}$	42083855.48	1403.76632
$P(10)_{28}$	41988681.24	1400.59165
$P(11)_{28}$	41892502.26	1397.38346
$P(12)_{28}$	41795322.93	1394.14191
$P(13)_{28}$	41697147.64	1390.86713
$P(14)_{28}$	41597980.73	1387.55928
$P(15)_{28}$	41497826.58	1384.21850
$P(16)_{28}$	41396689.51	1380.84493
$P(17)_{28}$	41294573.85	1377.43872
$P(18)_{28}$	41191483.93	1374.00001
$P(19)_{28}$	41087424.05	1370.52894
$P(20)_{28}$	40982398.49	1367.02567
$P(21)_{28}$	40876411.54	1363.49032
$P(22)_{28}$	40769467.46	1359.92305
$P(23)_{28}$	40661570.51	1356.32400
$P(24)_{28}$	40552724.93	1352.69330
$P(25)_{28}$	40442934.95	1349.03110

Vibrational band:  $\nu = 30 \rightarrow 29$ 

Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{29}$	41907298.90	1397.87702
$P(4)_{29}$	41819292.06	1394.94143
$P(5)_{29}$	41730252.88	1391.97140
$P(6)_{29}$	41640185.84	1388.96709
$P(7)_{29}$	41549095.39	1385.92864
$P(8)_{29}$	41456985.96	1382.85620
$P(9)_{29}$	41363861.99	1379.74992
$P(10)_{29}$	41269727.89	1376.60994
$P(11)_{29}$	41174588.07	1373.43642
$P(12)_{29}$	41078446.90	1370.22950
$P(13)_{29}$	40981308.77	1366.98932
$P(14)_{29}$	40883178.05	1363.71603
$P(15)_{29}$	40784059.07	1360.40978
$P(16)_{29}$	40683956.18	1357.07070
$P(17)_{29}$	40582873.70	1353.69895
$P(18)_{29}$	40480815.94	1350.29467
$P(19)_{29}$	40377787.19	1346.85801
$P(20)_{29}$	40273791.76	1343.38909
$P(21)_{29}$	40168833.89	1339.88807
$P(22)_{29}$	40062917.85	1336.35509
$P(23)_{29}$	39956047.88	1332.79030
$P(24)_{29}$	39848228.22	1329.19382
$P(25)_{29}$	39739463.07	1325.56580

Table 2. (cont.)

Vibrational band:  $\nu = 31 \rightarrow 30$ 

Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [cm <sup>-1</sup> ]
$P(3)_{30}$	41182684.77	1373.70650
$P(4)_{30}$	41095724.45	1370.80581
$P(5)_{30}$	41007730.55	1367.87065
$P(6)_{30}$	40918707.54	1364.90117
$P(7)_{30}$	40828659.90	1361.89750
$P(8)_{30}$	40737592.05	1358.85980
$P(9)_{30}$	40645508.44	1355.78822
$P(10)_{30}$	40552413.47	1352.68291
$P(11)_{30}$	40458311.57	1349.54401
$P(12)_{30}$	40363207.10	1346.37167
$P(13)_{30}$	40267104.45	1343.16603
$P(14)_{30}$	40170007.99	1339.92724
$P(15)_{30}$	40071922.05	1336.65544
$P(16)_{30}$	39972850.96	1333.35079
$P(17)_{30}$	39872799.06	1330.01341
$P(18)_{30}$	39771770.64	1326.64347
$P(19)_{30}$	39669769.98	1323.24109
$P(20)_{30}$	39566801.37	1319.80643
$P(21)_{30}$	39462869.07	1316.33962
$P(22)_{30}$	39357977.32	1312.84081
$P(23)_{30}$	39252130.35	1309.31013
$P(24)_{30}$	39145332.37	1305.74774
$P(25)_{30}$	39037587.59	1302.15376

Vibrational band:  $\nu = 32 \rightarrow 31$ 

Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [cm <sup>-1</sup> ]
$P(3)_{31}$	40459538.11	1349.58492
$P(4)_{31}$	40373624.82	1346.71916
$P(5)_{31}$	40286676.45	1343.81888
$P(6)_{31}$	40198697.48	1340.88422
$P(7)_{31}$	40109692.38	1337.91532
$P(8)_{31}$	40019665.60	1334.91235
$P(9)_{31}$	39928621.58	1331.87545
$P(10)_{31}$	39836564.73	1328.80477
$P(11)_{31}$	39743499.46	1325.70044
$P(12)_{31}$	39649430.17	1322.56263
$P(13)_{31}$	39554361.22	1319.39147
$P(14)_{31}$	39458296.97	1316.18711
$P(15)_{31}$	39361241.77	1312.94970
$P(16)_{31}$	39263199.95	1309.67938
$P(17)_{31}$	39164175.82	1306.37629
$P(18)_{31}$	39064173.67	1303.04057
$P(19)_{31}$	38963197.78	1299.67238
$P(20)_{31}$	38861252.43	1296.27185
$P(21)_{31}$	38758341.85	1292.83912
$P(22)_{31}$	38654470.28	1289.37434
$P(23)_{31}$	38549641.95	1285.87764
$P(24)_{31}$	38443861.04	1282.34917
$P(25)_{31}$	38337131.74	1278.78907

Table 2. (cont.)

Vibrational band:  $v = 33 \rightarrow 32$ 

Transition $P(J'')_{v''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{32}$	39737665.56	1325.50585
$P(4)_{32}$	39652799.98	1322.67503
$P(5)_{32}$	39566897.54	1319.80964
$P(6)_{32}$	39479962.72	1316.90980
$P(7)_{32}$	39392000.00	1313.97568
$P(8)_{32}$	39303013.82	1311.00742
$P(9)_{32}$	39213008.65	1308.00517
$P(10)_{32}$	39121988.89	1304.96908
$P(11)_{32}$	39029958.95	1301.89929
$P(12)_{32}$	38936923.23	1298.79596
$P(13)_{32}$	38842886.10	1295.65922
$P(14)_{32}$	38747851.92	1292.48922
$P(15)_{32}$	38651825.02	1289.28610
$P(16)_{32}$	38554809.72	1286.05002
$P(17)_{32}$	38456810.34	1282.78111
$P(18)_{32}$	38357831.16	1279.47952
$P(19)_{32}$	38257876.46	1276.14539
$P(20)_{32}$	38156950.48	1272.77887
$P(21)_{32}$	38055057.46	1269.38008
$P(22)_{32}$	37952201.63	1265.94918
$P(23)_{32}$	37848387.17	1262.48630
$P(24)_{32}$	37743618.29	1258.99159
$P(25)_{32}$	37637899.14	1255.46518

Vibrational band:  $v = 34 \rightarrow 33$ 

Transition $P(J'')_{v''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{33}$	39016852.89	1301.46212
$P(4)_{33}$	38933035.91	1298.66629
$P(5)_{33}$	38848179.96	1295.83580
$P(6)_{33}$	38762289.53	1292.97080
$P(7)_{33}$	38675369.11	1290.07145
$P(8)_{33}$	38587423.16	1287.13789
$P(9)_{33}$	38498456.12	1284.17027
$P(10)_{33}$	38408472.43	1281.16874
$P(11)_{33}$	38317476.49	1278.13344
$P(12)_{33}$	38225472.70	1275.06452
$P(13)_{33}$	38132465.42	1271.96213
$P(14)_{33}$	38038459.02	1268.82642
$P(15)_{33}$	37943457.82	1265.65752
$P(16)_{33}$	37847466.15	1262.45558
$P(17)_{33}$	37750488.29	1259.22075
$P(18)_{33}$	37652528.54	1255.95316
$P(19)_{33}$	37553591.15	1252.65297
$P(20)_{33}$	37453680.37	1249.32030
$P(21)_{33}$	37352800.41	1245.95531
$P(22)_{33}$	37250955.48	1242.55813
$P(23)_{33}$	37148149.76	1239.12890
$P(24)_{33}$	37044387.43	1235.66776
$P(25)_{33}$	36939672.62	1232.17485

Table 2. (cont.)

Vibrational band:  $v = 35 \rightarrow 34$ 

Transition $P(J'')_{v''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{34}$	38296863.66	1277.44587
$P(4)_{34}$	38214096.38	1274.68505
$P(5)_{34}$	38130287.67	1271.88949
$P(6)_{34}$	38045442.03	1269.05934
$P(7)_{34}$	37959563.96	1266.19476
$P(8)_{34}$	37872657.92	1263.29589
$P(9)_{34}$	37784728.38	1260.36287
$P(10)_{34}$	37695779.76	1257.39587
$P(11)_{34}$	37605816.47	1254.39501
$P(12)_{34}$	37514842.91	1251.36046
$P(13)_{34}$	37422863.44	1248.29236
$P(14)_{34}$	37329882.43	1245.19085
$P(15)_{34}$	37235904.19	1242.05607
$P(16)_{34}$	37140933.05	1238.88817
$P(17)_{34}$	37044973.29	1235.68730
$P(18)_{34}$	36948029.17	1232.45359
$P(19)_{34}$	36850104.96	1229.18719
$P(20)_{34}$	36751204.87	1225.88824
$P(21)_{34}$	36651333.12	1222.55688
$P(22)_{34}$	36550493.89	1219.19324
$P(23)_{34}$	36448691.36	1215.79748
$P(24)_{34}$	36345929.66	1212.36971
$P(25)_{34}$	36242212.92	1208.91010

Vibrational band:  $v = 36 \rightarrow 35$ 

Transition $P(J'')_{v''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{35}$	37577437.71	1253.44840
$P(4)_{35}$	37495721.49	1250.72264
$P(5)_{35}$	37412960.97	1247.96205
$P(6)_{35}$	37329160.70	1245.16677
$P(7)_{35}$	37244325.17	1242.33696
$P(8)_{35}$	37158458.86	1239.47277
$P(9)_{35}$	37071566.23	1236.57434
$P(10)_{35}$	36983651.71	1233.64183
$P(11)_{35}$	36894719.73	1230.67538
$P(12)_{35}$	36804774.67	1227.67514
$P(13)_{35}$	36713820.91	1224.64125
$P(14)_{35}$	36621862.79	1221.57385
$P(15)_{35}$	36528904.64	1218.47310
$P(16)_{35}$	36434950.76	1215.33914
$P(17)_{35}$	36340005.43	1212.17210
$P(18)_{35}$	36244072.92	1208.97214
$P(19)_{35}$	36147157.46	1205.73939
$P(20)_{35}$	36049263.26	1202.47399
$P(21)_{35}$	35950394.52	1199.17608
$P(22)_{35}$	35850555.41	1195.84581
$P(23)_{35}$	35749750.07	1192.48330
$P(24)_{35}$	35647982.62	1189.08871
$P(25)_{35}$	35545257.18	1185.66215

Table 2. (cont.)

Vibrational band:  $\nu = 37 \rightarrow 36$ 

Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{36}$	36858289.57	1229.46020
$P(4)_{36}$	36777626.03	1226.76956
$P(5)_{36}$	36695914.92	1224.04397
$P(6)_{36}$	36613160.80	1221.28359
$P(7)_{36}$	36529368.16	1218.48856
$P(8)_{36}$	36444541.51	1215.65905
$P(9)_{36}$	36358685.30	1212.79520
$P(10)_{36}$	36271803.99	1209.89715
$P(11)_{36}$	36183901.98	1206.96505
$P(12)_{36}$	36094983.68	1203.99906
$P(13)_{36}$	36005053.44	1200.99931
$P(14)_{36}$	35914115.62	1197.96595
$P(15)_{36}$	35822174.54	1194.89912
$P(16)_{36}$	35729234.49	1191.79898
$P(17)_{36}$	35635299.75	1188.66565
$P(18)_{36}$	35540374.56	1185.49929
$P(19)_{36}$	35444463.14	1182.30003
$P(20)_{36}$	35347569.71	1179.06801
$P(21)_{36}$	35249698.42	1175.80338
$P(22)_{36}$	35150853.44	1172.50626
$P(23)_{36}$	35051038.88	1169.17681
$P(24)_{36}$	34950258.84	1165.81515
$P(25)_{36}$	34848517.41	1162.42142

Vibrational band:  $\nu = 38 \rightarrow 37$ 

Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{37}$	36139106.65	1205.47084
$P(4)_{37}$	36059497.73	1202.81537
$P(5)_{37}$	35978837.51	1200.12484
$P(6)_{37}$	35897130.54	1197.39939
$P(7)_{37}$	35814381.35	1194.63917
$P(8)_{37}$	35730594.44	1191.84434
$P(9)_{37}$	35645774.28	1189.01504
$P(10)_{37}$	35559925.33	1186.15143
$P(11)_{37}$	35473052.00	1183.25365
$P(12)_{37}$	35385158.69	1180.32184
$P(13)_{37}$	35296249.76	1177.35616
$P(14)_{37}$	35206329.57	1174.35675
$P(15)_{37}$	35115402.41	1171.32374
$P(16)_{37}$	35023472.59	1168.25729
$P(17)_{37}$	34930544.37	1165.15754
$P(18)_{37}$	34836621.98	1162.02463
$P(19)_{37}$	34741709.62	1158.85869
$P(20)_{37}$	34645811.49	1155.65988
$P(21)_{37}$	34548931.74	1152.42832
$P(22)_{37}$	34451074.50	1149.16415
$P(23)_{37}$	34352243.86	1145.86751
$P(24)_{37}$	34252443.91	1142.53855
$P(25)_{37}$	34151678.68	1139.17738



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